Ad Hoc Triennial Review Committee:

Reconvened to Review Six
Water Quality Criteria Issues

February 18, 2009

Virginia State Water Control Board Meeting October 17, 2008

- Board Decision # 3:
- Direct staff to reconvene the triennial review ad hoc advisory committee to consider updates to the aquatic life criteria for ammonia, copper, cadmium, cyanide and lead in § 9VAC 25-260-140, Criteria for Surface Waters, and consider the need for a prohibition on any new or expanded mixing zones for persistent bioaccumulative toxic substances in § 9 VAC 25-260-20, General Criteria and Mixing Zones

Six Issues Separated out from Triennial Review for Additional Investigation

1. Ammonia criteria
2. Copper criteria
3. Cadmium criteria
4. Cyanide criteria
5. Lead (conversion factor)
6. Prohibition on mixing zones for persistent bioaccumulative toxic substances

These Involve Complex Issues

- Complete review and reassessment of criteria: ammonia, copper, cadmium, cyanide
- Review of conversion factor for lead; comparison of EPA's criteria data set and Virginia's criteria data set
- Consideration of implications of prohibiting mixing zones

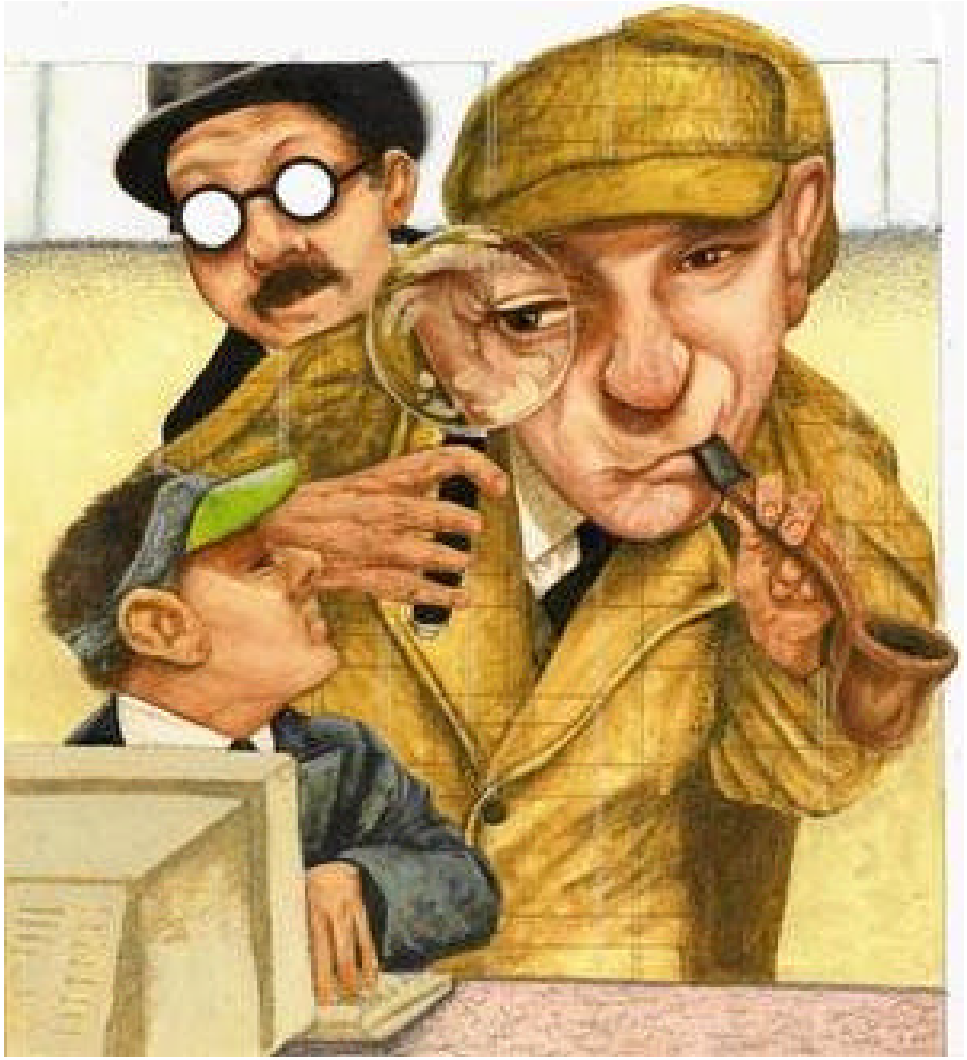
These Issues Required More Time for Detailed Investigation

- Triennial Review timeline requirements were insufficient to allow a thorough review of these issues.
- More time for investigation was desired.

Purpose of Reconvening the Ad Hoc Committee

- Review and discuss these six issues
- Assist DEQ in determining appropriate course of action
- Goal; DEQ desires to return to the State Water Control Board with recommendations on these six issues by Fall of 2009

Brief Descriptions of the Six Issues



Ammonia:

- USFWS and VDGIF recommended that DEQ adopt revised aquatic life criteria for ammonia that will be protective of freshwater mussels.

- Provided draft data that has been subsequently been published that shows freshwater mussels can be more sensitive to ammonia than standard test organisms contained in current criteria's data set.

Ammonia

- Recently published research on early life stages of several species of freshwater mussels indicate that adverse toxic effects are possible at concentrations of ammonia that are lower than what would be allowed by the current criteria for ammonia.

Ammonia: Options Discussed

- Revise ammonia criteria based on new scientific findings
- Apply the revised criteria to Endangered &Threatened Species waters critical habitat
- Apply the revised criteria to all state waters

Copper

- USFWS recommended that DEQ adopt revised aquatic life criteria for ammonia that will be protective of freshwater mussels.

- Provided draft data that has been subsequently published that shows freshwater mussels can be more sensitive to copper than the standard test organisms contained in current criteria’s data set

Copper: options discussed

- Revise Copper criterion based on new scientific findings
- Apply the revised criteria to Endangered &Threatened Species waters critical habitat
- Apply the revised criteria to all state waters

Cadmium: Option Considered

Revise Virginia's cadmium criteria based on EPA 2000 304(a) published criteria:

Acute 3.9 µg/l to 2.0 at 100 hardness

Chronic 1.1 µg/l to .25 at 100 hardness

Cadmium: Newer Information Provide Suggested Updates for EPA's 2000 Criteria

- VAMWA provided a recent report recommending an updated water quality criteria for cadmium
- Another similar report available from USGS
- Each report includes additional, newer information than the existing updated (2000) EPA criteria document

Cyanide

- Recent report in 2007provided by VAMWA recommended updated water quality criteria for cyanide

Lead Criteria Conversion Factor

- EPA considers the incorporation of a conversion factor necessary to convert the older criteria for metals based on “total recoverable” measurements to criteria for metals expressed as “dissolved” criteria
- EPA recommends a conversion factor to be applied to EPA’s recommended criteria for lead to convert the criteria to a “dissolved” criteria
- The basis for Virginia’s water quality criteria for lead is different than EPA’s criteria

Lead: Virginia Criteria Differs From EPA's Criteria

- Virginia updated the criteria for lead in 1996 and the basis for our criteria is different than EPA's 1985 criteria
- The conversion factor recommended by EPA for their criteria may not be appropriate for Virginia's criteria due to the different data sets used

Mixing Zones

- USFWS and CBF supported an amendment to prohibit any new or expanded mixing zones for persistent bioaccumulative toxic substances.

Mixing Zone Prohibition

Concern:

- Fish or shellfish residing in the mixing zone could be exposed to higher concentrations of the toxic pollutant.
- This could result in the resident fish or shellfish bioaccumulating the toxic pollutant to levels higher than intended by the criteria which applies outside the mixing zone.
- This is a fish-consumption human health risk issue.

More Detailed Discussion on Lead Conversion Factor

Conversion Factors for Metals' Criteria

- The original (1980s)EPA recommended water quality criteria for metals were listed as being applicable to the "total recoverable" metal measurement.

- It was recognized that the intent was to apply the criteria to the "biologically available form" of the metal

“Dissolved Metal” was Recognized as the Best Measurement Equivalent to the Biologically Available Metal

Many States Adopted the EPA Criteria Values as Dissolved Values

- EPA believed that a conversion factor was needed to convert the older criteria values that had been expressed as total recoverable metals to the newer “dissolved” metals terminology
- EPA developed recommended “conversion factors” to “convert” the original criteria values to dissolved values
- Conversion factors were developed for the specific metal’s criteria based on the original data used to calculate the criteria

Conversion Factors

Original toxicity tests in the 1980s and 1990s that are the basis for many of the metals' criteria determined the toxicity values (e.g. LC_{50} values) using several different methods.

- nominal concentrations
- total recoverable concentrations
- dissolved concentrations
- other measurements
- static tests, renewal tests, flow-through tests

EPA Developed Recommendations for Conversion Factors

- EPA developed recommendations for conversion factors for the metals' criteria based on the type of tests that most influenced the calculation of the criteria.

- Unique for each metal's data set

Virginia Revised the Lead Criteria in 1995-1996 Based on EPA's Dataset Updated With Additional Recent Toxicity Data

(No conversion factor was applied)

Existing Virginia Lead Criterion

Lead (mg/l)[5]

Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/l and the water effect ratio. The minimum hardness allowed for use in the equation below shall be 25 and the maximum hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400.

Freshwater acute criterion (mg/l)

WER [e {1.273[ln(hardness)] **-1.084**}

Freshwater chronic criterion (mg/l)

WER [e {1.273[ln(hardness)] **- 3.259**}]

WER = Water Effect Ratio =1 unless shown otherwise under 9 VAC 25-260-140.F and listed in 9 VAC 25-260-310

e = natural antilogarithm

ln = natural logarithm

Footnote # 5 for Metals Criteria Expresses the Criteria as Dissolved

5 Acute and chronic saltwater and freshwater **aquatic life criteria apply to the biologically available form of the metal** and apply as a function of the pollutant's water effect ratio (WER) as defined in 9 VAC 25-260-140 F (WER X criterion.) **Metals measured as dissolved shall be considered to be biologically available**, or, because local receiving water characteristics may otherwise affect the biological availability of the metal, the biologically available equivalent measurement of the metal can be further defined by determining a Water Effect Ratio (WER) and multiplying the numerical value shown in 9 VAC 25-260-140 B by the WER. Refer to 9 VAC 25-260-140 F. Values displayed above in the table are examples and correspond to a (WER) of 1.0. Metals criteria have been adjusted to convert the total recoverable fraction to dissolved fraction using a conversion factor. Criteria that change with hardness have the conversion factor listed in the table above.

EPA's Lead Criteria; Recommended Conversion Factors

Freshwater CF (acute & chronic) is hardness variable and is given by an equation:

1.46203-[(ln hardness)(0.145712)]

Saltwater CF (acute & chronic) is **0.951**

Examples of Freshwater CF at Different Hardness Levels

Hardness (as mg/L $CaCO_3$)	**Conversion Factor**
25	0.9930
50	0.8920
100	0.7910
150	0.7319

Virginia Criteria for Lead

VA lead criteria for freshwater and saltwater are different from EPA's criteria because we recalculated these criteria values using additional published literature (Recalculation of the WQS for Lead, Triennial Review, Nov. 14, 1996). This was approved by EPA in 2000.

Virginia Criteria for Lead

- Some of the toxicity tests that influence the Virginia lead criteria are different than the tests that are the basis for EPA's lead criteria.

- Concern that the appropriate conversion factor for Virginia's lead criteria may be different than EPA's.

DEQ's Recommended Approach

- Follow EPA's approach to applying a conversion factor to a metal criteria, depending on the types of data from the important toxicity tests, but adjusted to the data set that is the basis for the Virginia lead criteria.
- Review the original literature that directly influences the Virginia criteria for lead.
- Determine the type of measurements of lead used in the critical tests that directly influence the criteria calculations.

DEQ's Recommended Approach (continued)

- Where needed, adjust the original test's LC_{50} values to dissolved concentrations.
- Assess if a conversion factor should be applied to the important tests' results individually, or to the finished criteria.
- Account for any differences between acute or chronic tests conditions.
- Determine whether the recommended EPA conversion factor is appropriate for Virginia's criteria, or…
- Determine whether to recalculate the criteria based on the dissolved concentrations or by applying using a conversion factor to the finished criteria.

Committee Discussions

- Approach to the issues outlined.
- Other things to consider related to these six issues?
- Other suggestions?
- Any new information?

Future Meetings

Date	Main Topics
March 26, 2009	Lead and Mixing Zones
April 15, 2009	Cadmium & Cyanide
May 26, 2009	Ammonia & Copper
June 17, 2009	As needed